TECHNIQUES APPROPRIATE FOR THE VILLAGES - SOME EXAMPLES

CENTRE OF SCIENCES FOR THE VILLAGES

MAGAN SANGRAHALAYA, WARDHA –442001

January, 1978

Price Rs: Five

Techniques Appropriate For The Villages :

Herein, are collected some examples of techniques appropriate for the villages which could be tried for being introduced in the rural scene. These are of course, only few of the many that are available but it is expected that this short list will be illustrative of the kind of processes we are to identify for rural application. The aim should be to give priority to such, which assist the poormost and have a larger quotient of replecability. The list is devided into four Sections viz :-

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COMMUNITY HEALTH CELL
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AGRICULTURE PROCESSES, TOOLS AND APPLIANCES

1.1 Catharanthus Roseus (Vinca Rosea Linn) Cultivation :

The Indian Periwinkles known as 'Sada Bahar' 'Bara Masi' ever blooming plant and referred to as Vinca Rosea Linn is a plant which yields alkaloidsfrom leaves, stem and root which are highly prized medicine in the treatment of Hodgin's disease, a form of cancer of lymph glands, spleen and liver and chorio carninoma. Nearly 200 tons of leaves and 100 tons of roots are exported every year. The STC buys the stems @ Rs.0-75/kg., dried leaves @ Rs. 2-75/kg. and air dried roots @ Rs. 4-50/kg. The seeds which are rather difficult to gather because of shattering nature are purchased @ Rs.45-00/kg.

For its cultivation 5 kg/hectare are sown in lines 45 cm.apart in May. The distance between plants being kept at 30 cm. The flowers come in two and half months time and continue whole of the year round. The first collection of leaves is done by stripping

the plants in October and subsequently in February and April. The plants are dug out in the last week of April and roots severed off. Leaves take 15 days for drying in the shade. The roots are washed free of soil and dried for the same period in shade. Per hectare 3.6 tons of dry leaves and 1.5 tons of dried roots can be obtained which would yield an income of Rs. 16,000/-. Catharanthus Roseus can be grown successfully on any kind of soil, except water logged soils.

(Source : Central Indian Medicinal Plants Organization,
National Aeronautical Laboratory Campus, Bangalore).

1.2 Grain Storage in Clay Silo and other Storage Systems :

To arrest wastage in storage at the farmer's house, improved storage silos, which are simple and cheap for the farmer have been designed.

A one ton silo costing Rs. 200/- approximately can be made on a 15 cm. thick circular base of hard core of brick bats and a 7.5 cm. thick wall made of 3.1 cm. thick pre-cast clay inner rings

with a split bamboo reinforcement bitumen layer vapour barrier, and given a in situ clay outer layer finish like mud walls. This is effective in preserving food grains against vermins, insects, external beat, moisture etc. Several other indoor and outdoor storage bins have been developed and tested. These bins could be made of mud, bamboo, earthen-ware, masonery, metal and wood individually or in combination.

(Source: C.B.R.I. Roorkee (U.P.); I.P.R.I. Bangalore (Karnataka))

1.3 Grain Storage - Bulk Storage Structures in the Tropics :

An ideal storage structure which is damp proof, air-tight, with thermal resistance made out of the common building material had been constructed and efficiency tested by CBRI. The material for construction : Bricks, hollow tiles, concrete, concrete blocks and tanker etc. Thermal insulation : (i) use of clay, (ii) cavity wall, (iii) cheap insulation material like rice husk or saw dust etc. and (iv) location - underground or shaded location. Vapour

barrier materials: asphelt felts and asphalt papers, asphalt paints and coatings, polythene films.

Cost of Structures

Capacity	S.No.	Type of structure	Cost Rs.	Cost/ tonne
1 Tonne	1.	Above ground clay silo	235	235
	2.	Above ground cavity wall (4 1/2" wall)	660	660
	3.	- 9" wall -	845	845
	4.	Above ground double cavity brick silo	920	920
	5.	Above ground and hollow tile silo	495	495
	6.	Above ground concrete silo	495	495
	7.	Underground concrete bin	270	270
	8.	Underground brick bin	325	325

(Source : CBRI, Roorkee, U.P.)

1.4 Hay Press : Pressed hay or grass retains its quality longer than stacked hay. A simple device enables three workers to produce about 5 bales/hour. It is a wooden device consisting of a bale mould in two sections (37 x 33 x 110 cm.) with arrangement for wiring, in which the pressing platform works by leverage and a system of holes in the rod working the press plate along which the pin is moved to get more and more hay pressed. Finally, when the mould is filled, the wires are tied under pressure, the locks of the two sections of the mould are opened and the pressed bale removed.

(Source : Agricultural Engineering Institute, Govt. of Israel, The Volcani Center, Bet Dagan, P.O.B. 6, Israel)

1.5 Maize Sheller : Traditionally stripping or shelling is done with the thumb or else by beating them with a stick in a sack. The design of the stripper which has been developed consists of a short length tube having internal ribs or fins in the direction of the cylinder axis. The device is held in one hand while with the other hand the maize cob is pushed into the tube with a twisting action.

The ribs engage the rows of grains and strip them off in a rapid succession. It can be made of aluminium, but a PVC pipe with a slit made along the tube, due to its flexibility is better because it can take in larger size of maize cobs also.

(Source : Dr. D.J. Hilton, Deptt. of Mechanical Engg.
University of Nairobi, Kenya)

1.6 Mushroom Cultivation : Mushrooms have great potentiality of consumption in India as well as abroad and can be easily grown anywhere. Mushroom cultivation is possible even for small householders on a well drained ground or a pucca floor indoors where it is protected from strong winds, where the process could be carried out in a space of 6' x 6'. Spawn which is the seed of the mushroom, is to be obtained from a lab (RRL, Jammu; NBG, Lucknow; ARI, Coimbatore; Mycology Division IARI, New Delhi). These are to be grown during March to Oct. on a bed of wet paddy straw in 28 budles of 1 1/2 lb. (3 ft. long 5-6 inches in diam.).

Mushroom appear in 2 to 3 weeks and the yield per bed is 2.5 to 3 kg.

(Source: The Mycology Division, Indian Agricultural Research Institute, New Delhi can supply detailed information.)

1.7 Winnowing Fan : It is a small box with a hand operated fan inside. The mixture of husk and dehusked grains is poured into a hopper which opens out across the current of air. The husk is blown away and the grain collected below the machine.

(Source : KVIC, Bombay)

II

RURAL CRAFTS & INDUSTRIES

2.1 Agriculture Waste Utilization for Hard Boards : Millions of tons of agro-wastes of various types are annually available in the villages. These can be used to prepare particle boards. Several types of boards have been made which are fairly strong and durable, look very attractive and can be used as partition material. The R.R.L. of the CSIR at Jammu - Srinagar has worked in this line. At R.R.L. Jorhat a process of binding the particles without any adhesive, by heating the fibre to a temperature where some tar is released and pressing it then, makes the boards waterproof.

(Source : Regional Research Laboratory, CSIR, Jorhat-6)

2.2 Bamboo - Chemical Seasoning : The Forest Research Institute, Dehradun has evolved a simple process for making the round bamboo treated against cracking, splitting, fungal, discolouration or insect attack by giving it an anti-shrink cum anti-septic treatment, to the process offers the possibility for handicrafts manufacturers to utilize bamboos, in forms hitherto little used, to produce new forms, designs and articles apart from existing range. The process consists in giving a soaking treatment to portions of the required length from green, preferably freshly cut, culms of bamboo in a tank containing a water solution of polythylene glycol (PEG: Mol.wt.600) to which a suitable preservative has been added, followed by air or kiln seasoning in the normal manner. During soaking treatment the chemical diffuses into the green-wood, replacing moisture in the cell walls and thereby preventing their shrinkage in subsequent seasoning.

(Source : Forest Research Institute, Dehra Dun).

2.3 Chakki Powered by Single Bullock : In this chakki, a single bullock rotates a big iron wheel, 62 inches in diameter, by a wooden beam which is 12 feet long. This wheel is connected by a small gear wheel to the bottom stone of the chakki. For one round of the bullock, this bottom stone will turn round 14 times. The gap between the grinding stones can be adjusted easily. The grinding stones are of the approved Agra stone chakki type. 30 inches in diameter.

2.4 Coir Waste for Corrugated Roofing Sheets : Unlike other cellulosic materials, coconut fibre is free from water soluble polyphenols and make a strong board with portland cement. Coir fibre is soaked in mineralised water for 2 hours. The free water is drained off and the fibre mixed with dry cement. Next, a mat of suitable thickness is formed on a corrugated mould and held under pressure for 4 to 8 hours. After demoulding, the sheet is cured and dried. These sheets are fire resistant, water proof require less cement and are cheap.
(Source : KVIC, Bombay)

2.5 Crayon (Chalk) from Lime : Instead of 95% plaster of Paris and 5% China clay, a cheaper yet efficient process of crayon making has been found out, which will be useful for the villages. Here only 70% Plaster of Paris is taken and 30% slaked lime is added to it. This simple industry can be started in schools or big village to cater to supply the needs of about 100 schools. A chalk mould of gun metal costs Rs. 400/- for a dozen cavities, Rs. 525/- for 2 dozens and Rs. 625/- for 3 dozens. The product is lighter, more durable and better in writing.

(Source : Directorate of Lime Industry, Khadi & Village Industries Commission, Vile Parle (West), Bombay-56)

2.6 Cotton Stock Utilization : Cotton stock can be used for making particle-board; cotton leaf for extracting vitamin C; cotton seed for processing hydrogenated fats, fatty acids and cakes; cotton linters as source of cellulose; and cotton cake for solvent extraction of oil, leaving a residue that can be used as

animal feed. The necessary technology for integrated production of cotton cut lints, hulls, crude refined oil, soapstock fatty-acids, de-oiled cake, edible flour, and tailings has been developed. The 'chemical cotton' thus produced is used for a series of chemical derivatives from which are manufactured rayon, plastics, protective coatings, films and foils. The cotton seed is converted into edible flour and other products by pre-processing and solvent extraction method. The crude oil is refined and the soapstock obtained during refining is converted into fatty acids. The hulls are compounded into cattle feed.

(Source : R.R.L., Hyderabad. (Andhra Pradesh)

2.7 Dehusker for Rice : The implement can be operated by two adult persons in standing posture by moving handles in opposite directions. The grain of paddy strikes against the hard rubber ring and the grain is shelled. The rubber ring requires replacement after 100 qtls. of production. The machine is made of

cast-iron and steel parts, it requires 3500 revolutions per minute for better result by moving handles at 45 to 50 per minute and it can process about 150 kg. to 180 kg. of paddy per hour.

2.8 Dehusker for Pulses : It is like paddy dehusking machine and can dehusk 50 to 70 kg. of pulses.

(Source : KVIC, Bombay)

2.9 Fish Meal : Out of 10 lakh tons of fish produced in India 1 lakh tons is classified as 'trash' plus a sizable quantity of fish processing wastes are available from the fish processing industries. From these raw materials good quantity of fish meal can be produced for being used in poultry and dairying industries. There are extent methods traditionally persued, the scientific method is (i) cutting the fish to smaller pieces, (ii) cooking the chopped fish to soften the flesh and release the oil, (iii) from this cooked meal expel the liquid, (iv) drying the pressed cake, (v) grinding it and packing in insect-proof gunny bags. The equipments required are simple, cooker (Rs. 300/-), dryer (Rs. 200/-), Press (Rs. 1,000/-) and mortar, pestle, knives

etc. (Rs. 200/-). Total investment being Rs.1,700/-. Per day two batches can be taken out processing 50 kg. of fish. In 150 days of fishing season November to March, 3,300 kgs. of meal can be marketed @ Rs. 2.50/kg giving 30% return on the capital.

(Source : Regional Research Lab. CSIR, Bhubaneshwar)

2.10 Jute Blending with Wool : Technology for suitably blending jute/wool and jute/viscose to make woollens has been developed.

(Source : I.J.I.R.A. Calcutta (West Bengal).

2.11 Oils - Essential :

(a) Citronella Oil : Cultivation and extraction of oil from Java citronella grass gives an essential oil for perfumes, perfuming sprays, disinfectants, polishes, mosquito repellant creams. The world production is over 5000 tons whereas India produces only one fourth of its own small requirements of 200 tons (worth 45 lakh Rupees). The grass can be grown in all soils except heavy and poor texture loan planted with a spacing of 60 x 60 cm.

It can run for four to five years with profit. Per hectare fresh grass 300-400 qtls. are obtained giving '6' to '8% oil, by distillation of leaves of the grass in a 100 kg. steam and distillation plant where steam can be supplied from separate boiler or by burning fuel below the still itself. The oil fetched in 1973 Rs. 60/kg. and per hectare the Regional Research Laboratory of the CSIR, Bhubaneshwar (Orissa) got a profit of Rs. 6,000/- where all labour and other charges are also paid. The self employed cultivator can make double this profit on his less productive land.

(Source : R.R.L. Bhubaneshwar and CIMPO, National Botanical Gardens, Lucknow.)

(b) Japanese Mint Oil : This perennial aromatic herb can be grown in well drained soils to be planted fresh every year and gives three crops viz. May, Aug, and November, yielding 10-12 qlts/year which can be sold as such @ Rs. 2/kg or converted

into oil 40-45 kg. fetching about Rs. 100/kg. The oils is used for making Menthal and in pharmaceutical and technical preparations like tooth pastes, mouth washes, shaving cream, after shave lotions, confectionaries etc.

(Source : R.R.L. Bhubaneshwar)

(c) Palmarosa Oil :

a) used in soaps and luxurious items as perfumes,

b) prepared from Palmarosa grass (Maharashtra, Gujrat, Hyderabad, Madras),

c) equipment (distillation plant) + building + Land (100 acres)
Rs.50,000/- Rs.50,000/- Rs.50,000/-

d) cost of production Rs. 90,000 per season including Rs.34,000 for labour + supervision,

d') persons employed 35,

e) production 1600 kg. per season

f) selling price 120 per kg; cost Rs. 57/- per kg.

g) over all export 20,700 kg. per annum Rs. 15,00,000/-.

h) the salaries of persons employed would go around 300/- P.M.

(Source : Regional Research Laboratory, Jorhat, Assam, CSIR).

(d) Oil - Distillation : Like the oil of Palm rosa and Citronella etc. other sources like orange peal, eucelyptus leaves, lemon grass, Deodar-sawdust and all other odouriferous vegetable products like leaves, flowers, fruits or roots available in various seasons can be distilled for essential oils at the village level. For this purpose stills can be designed which will serve universally for all these different raw materials and give the oils as per the need of the season and place.
(Source : National Botanical Gardens, Lucknow)

2.12 Pine Needle Utilization : A process to produce fibre-boards from pine needles has been developed. Packing cases made of these boards have been found useful for packing and transporting fruits over longer distances. These packings are cheap, durable and easy to assemble or dismantle.

2.13 Salt Lick for Cattle : Presently hardly 10-15,000 blocks of licks are coming in the market, For cattle-health this product has great potentialities. Finely ground salt is mixed with

requisite quantity of calcined magnesite and magnesium chloride solution and transferred into moulds for 2 kg. or 25 kg. blocks and pressed gently in the mould and allowed to remain for a few hours and then the moulded salt is taken out and exposed to sunlight for 8 hours. This gives a hard blocks of cattle licks which has added supplimentary nutrients such as cobalt chloride. Iron exide, etc. A 200 kg. (2 kg blocks) per day project can be worked in a Rs. 20,000/- investment which could be recovered in a year.

(Source : The Central Salt and Marine Chemical Research Instt. Bhavnagar: Gujrat).

2.14 Soap - Low Cost : This soap can be made by unskilled people by the "Cold Process". Gradual addition of warm oil ($40^{\circ}C$) to warm ($40^{\circ}C$) 30% acqueous sodium hydroxide containing a little dissolved soap, with constant stirring ensures satisfactory results. The soap hardens in one to four days, depending on the oil charge used.

Cost can be reduced by the blend of coconut oil (more than 75%) with groundnut, castor, neem, karanja oils to produce hard soap with good leathering properties. Cost can be further reduced by using chalk as a filler to the extent of 10% of the weight.

(Source : ASTRA, Bangalore)

2.15 Tanning with Vegetable Materials : Barks, nuts and leaves available in abundance in rural areas can be used as tarning materials for leather.

(Source : Central Leather Research Institute, Madras

RURAL HOUSING & ENVIRONMENTAL ENGINEERING

3.1 Bamboo Concrete : Bamboo can be safely used as reinforcement upto 4.25 metres span. Mixture of white lead and 10% varnish brushed on bamboo strips or Gloss oil has been found excellent inhibitor against any shrinkage and swelling effects due to absorption of moisture by bamboo strips when embodied in green concrete. Economy of Bamboo reinforced roof slab upto 4.5 m. as compared to steel reinforced roof slab is 33% taking Rs.864/ton as cost of steel. Lintels, sunshades, cantilevered porticoo, pionic sheds, T-teams, fence posts etc. can also be made. A load bearing beam of 4 metre span with bamboo reinforcement takes 745 kg/metre length of load. Bamboo can be effectively used as reinforcement in cost - in - situ or precast structural components with considerable economy. Bamboo of 2 1/2 years to 4 years maturity is recommended for reinforcement.

(Source : Director, Forest Products Research Timber Engg. Branch, Forest Research Institute, Dehradun U.P.)

3.2 Bricks from Black Cotton Soil : The heavy clay of black cotton soil inhibits in good brick making. This process consists of making bricks from black cotton soil, by mixing it with 30% by volume of partially calcined clay (grog) prepared by lighting calcined lumps of clay in a clamp using coal as fuel and grinding it to 2 mm. size. The black clay is washed to remove the lime Kankar before mixing it with grog. The bricks are burnt at the usual temperature of 950°C. The cost of such bricks is well comparable with that of ordinary bricks and leads to strengthening of the brick from 35 kg/cm^2 of conventional bricks to 120 kg/cm^2 and is also more durable.

(Source : CBRI, Roorkee U.P.)

3.3 Bricks Using Paddy Husk Ash : Which can be used for construction purposes like burnt clay bricks - the process perfected at R.R.L. Jorhat

3.4 Cement - Ashmoh : The process of making cement by admixture of slaked line with paddy husk ash and pulversing it in a ball mill for 4 to 6 hours can be easily installed in the villages to make them self-sufficient for their need in cement. This process has been designed at the IIT, Kanpur and is being successfully applied at the village Atarra in dist. Banda of U.P. by a scientist rural social worker Dr. Bharatendu Prakash.

3.5 Cement Replacement - Puzzolana: The burnt clay puzzolana, commonly known as the reactive surkhi, has been developed. It can be used for partial replacement of cement in many construction works. Together with lime, it can be used directly as a cementing medium as well.

Fruitful researches have also been carried out for developing special bituminous road binders and for modifying road binders for use under special situations.

Source : C.R.R.I., Okhla (New Delhi)

3.6 Cement Replacement - Fly Ash : 15-20% cement can be replaced by weight by fly ash - an industrial waste, by admixture either at the Cement Factory or at site, without in any way affecting its strength. This helps in utilization of the waste, saving of the Cement and increases the workability of concrete in lean mixtures and net saving equal to the cost of the cement replaced. Cement Concrete laid by this method must be vibrated or water reducing admixture (0.2% by weight) added.

(Source : CBRI (Technical note No. 20)

3.7 Lime for Building from Sugar Press Mud : The lime sludge in the mill and Khandsari industry is an industrial waste. Lime of good quality for building purposes could be made from it, by a process of making briquettes (at a pressure of 210 kg/cm^2) of the press mud obtained both in carbonization and sulphitation processing in sugar industry. These are sun dried and then calcined in ordinary lime kilns. The estimated cost is

approximately Rs. 50/- per tonne of lime, of ISI class A or class B specification. The higher the pressure for briquetting, the better is the lime produced.

(Source : CBRI, Roorkee U.P.)

3.8 Mud-wall Plaster - Non Erodable : The common mud plaster applied to cover the mud walls of a village gets eroded during monsoons. Experiments made at CBRI, Roorkee have found out a method to make this plaster non-erodable and water-proof. This technique if taken to the villages will help the poor very much and also give some of them a source of employment. It will solve the present problem where mud houses fall down due to excessive rains and the outer wall hit directly by rains is to be plastered again and again requiring much time and energy - which tells upon the earning of the hut dwellers. This is done by the following process which gives 5-7 years of life to the

water-proof exterior of the mud wall at an extra cost of Rs. 6 to 10 for 100 sq.ft.aarea.

The mud plaster is made, as is usual in the villages, with proper portion of clay and sand content of soil and kneaded with Bhusa or such grassy material which acts as binder and kept for 10-12 days to mature. To this is to be added a preparation of bitumen. This preparation is made by melting 100 lbs. of bitumen and dissolving it in 20 lbs. of kerosene oil and mixing with it one lb. of molten wax. For every 1 cu.ft. of soil used in preparing the plaster 4 lbs. (by weight) of this bitumen preparation is to be added and well kneaded before applying to the upper surface of the cleaned mud wall. This solution can also be sprayed directly on the walls by insecticide spray pumps used by the agriculturists.

This process is simple and 1 sq. meter of surface can be covered at a cost of Rs.1.50. Its application can be very wide

in the country and the results very satisfying for the dwellers behind mud walls.

(Source : Central Building Research Institute, Roorkee U.P.)

3.9 Roads - Use of Local Materials : A variety of techniques, including those related to blending of local soils, soil-aggregates like laterite, kankar, moorum, etc. in road construction have been developed. Solution has been found for harnessing the problematic black cotton soils found in Madhya Pradesh, Maharashtra, Andhra Pradesh and other southern regions. This has been done by treating the black cotton soil with lime. These techniques have not only helped to make significant economies in the cost of road construction but also lead to conserve resources of high quality materials.

(Source : C.F.T.R.I., Mysore (Karnataka).

3.10 Road Binders : Fruitful researches have also been carried out for developing special bituminous road binders and for modifying road binders for use under special situations.

Source : C.R.R.I., Okhla (New Delhi)

3.11 Roof Slabs : Roofs constitute nearly 25% of the cost of buildings. They also consume two of the scarce materials, namely steel and cement. Further, in SITU roofs and floors constructed by conventional methods consume lot of time. Prefabricated roofing/flooring elements on the other hand can help save both time and money. A number of processes for prefabricating roofing and flooring units which lead to economy in cost and time have been developed. Besides, they consume less cement and steel as compared to conventional R.C.C. slabs.

Source : C.B.R.I., Roorkee (U.P.)

3.12 Thatch Roof :

(a) Fungi & Fire Resistant Treatment : The main drawbacks of a thatch roof are its short life, high fire risk and harbouring of insects and vermins. Investigations have shown that the life of the thatch can be increased from usual 2-3 years to 15-20 years by suitable preservative treatments. The preservative chemical consists of a solution of 4 kg. copper sulphate, 4 kg. sodium chromate and 0.35 kg. acetic acid dissolved in 100 litres of water. Thatch grass dried to a moister content of 12 to 15% is dipped in this solution turned over for complete wetting and kept submerged for six hours. Then it is removed, drained and dried. The cost, through this treatment, is increased by double to that of untreated thatch leaves. This treatment is resistant to leaching by rain water. Thatch thus treated does not harbour insects and varmins.

To make thatch fire resistant, solution in 100 litres of water should have 31 kg. Boric acid, 1.0 kg., Copper Sulphate 5.1 kg. Zinc Chloride and 6.2 kg. Sodium Dichromate. The treatment time is 32 hours and the cost is five times that of ordinary thatch. For cheaper approach two other methods are there, (i) Fungi treated grass, as stated in the first process, is compressed under slight pressure of 0.01 kg/cm^2 and tied between split bamboo into slabs. These slabs can be used for roofing as shingles are used. (ii) A surface coating of cement or mud on the thatch from inside and outside. Inside ceiling is plastered with bitumen stabilized mud plaster and the same is thinned to a consistency of a whitewash by addition of water and is applied on the roof in two coats.

Untold number of thatched dwellings are destroyed by fire every year in the country. In Vijaywada city of Andhra Pradesh alone, there were nearly hundred fire incidents in 1968. It is, therefore, desirable to apply a fire protection coat on the thatched roofs. However, such a treatment suitable for wide

use must be based on readily available material and the level of skill required in its use should be as low as possible. Keeping these requirements in view the bitumen mud plaster mentioned before is used to seal the lower surface of thatch roofs against fire.

(b) Fire Retardant Treatment : Dry thatching material can be made fire resistant by dipping it in a chemical solution and drying it. The chemical solution is a 15 per cent solution in water of fertilizer grade Di-Ammonium Phosphate and Sodium Fluoride premixed in the ratio of 99.95 : 0.05 by weight respectively.

However the chemical coating may be washed away by repeated rainfall. To make it water proof it is essential to spray the thatch material with water repellant plant, a mixture of zinc oxide, Talc powder and other chemicals.

(Source : CBRI, Roorkee (U.P.))

3.13 Desalination : A process for desalination of brackish water to produce drinking water and a plant of 15,000 litres/ day capacity has been developed successfully and commissioned in Rajasthali, a drought affected village in Amreli district of Gujarat State.

(Source : C.S.M.C.R.I., Bhavnagar (Gujarat))

3.14 Disinfection of Water : Technology for defloridation and disinfection of drinking water by treating it with lime, alum bleaching powder followed by flocculation and sedimentation has been developed. Also chlorine ampoules and tablets for disinfection of rural domestic drinking water have been developed.

(Source : C.B.R.I., Roorkee (U.P.))

3.15 Water Filter Candles : A process for manufacture of inexpensive water filter candles, which can be fitted to domestic water containers, including earthern pitchers, to meet the daily requirements of an average family, has been developed.

100 candles per day plant, investment Rs. 10,000/-
Cost of production Rs. 4/- per candle
Imported candles cost Rs. 60/- per candle.
2-4 people will suffice.

(Source : R.R.L., Jorhat (Assam).
C.G.C.R.I., Calcutta (West Bengal))

ENERGY & FUELS

4.1 Bio-gas : With about 23 crore cattle population producing daily 1.3 lakh tons of wet dung, the biogas is a rich source of energy. The estimate is that if biogas is got from all the cowdung and the human waste in India we could get heat equivalent of 92 crore tons of coal or 6.5 crore tons of petrol. The fertilizer that we will get, over and above the fuel gas, even if we use only the portion of cowdung that is today burnt as fuel, will be equivalent to six times the annual output of the Sindi Fertilizer Factory.

The Khadi Commission has developed a gas plant costing Rs. 5,000/- which will give 10 cubic metres of gas every day and yield 50 tons of fertilizers in the year. Immense potentialities lie in harnessing this wasted source of energy.

(Source : Khadi & Village Industries Commission, Irla Road Vile Parle (West), Bombay-56).

4.2 Bullock-Cart : Modernization of bullock cart can help 15 million animal drawn vehicles of India having a total investment of Rs.3,000 crores and employing 1.6 million people. Many designs are being put forth by various institutions. One of them is from the National Institute of Design, Ahmedabad. This has three comparatively small wheels; the animals are not burdened with the entire load, but only required to pull the cart. The two rear wheels are pneumatic while the front wheel is solid. The huts and spokes are of wood. The existing hubs can be used as they are, or can be turned smaller. Similarly, the spokes can also be made from old wooden wheels. The steel rim is fitted over the spokes. The hub has two conical roller bearings to minimise friction.

The axile beam is a steel pipe fitted with wooden cylinders at both ends. The card frame consists of three longitudinal wooden beams bolted to the axle beam. The front wheel acts as a guiding wheel. It has wooden spokes and fabricated steel rim, over which a solid rubber tyre is fixed. This can be easily made from an old rubber tyre by cutting off the side walls.

The yoke beam is attached to the front wheel. The yoke beam and the draw bar together are free to move in three planes, reducing the load and injurious effects on the bullocks considerably. The other problem is damage to the hoofs on rough grounds. The traditional solution is to nail metal shoes on to the hoofs. But observations revealed that the metal shoes slip on paved roads and are dangerous on wet roads. To avoid this, rubber pads from pieces of old rubber tyre are fixed to the hoof. The total cost of the new bullock cart would not exceed that of the existing one.

(Source : National Institute of Design, Ahmedabad).

4.3 Burner for Poor Quality Kerosene : An air burner for hurricane lanterns and a deva which would utilise poorer quality of kerosene has been developed. The technology helps reduce smoke and other formation on the wick and gives more initial candle-power.

(Source : I.I.P., Dehradun (U.P.))

4.4 Irrigation Pumps : Reducing Energy Consumption : Common arrangement of a pumpset discharging water horizontally or vertically downwards using a small elbow wastes energy in the discharge of water due to the pressure head and velocity head.

The constant load due to the height of the discharge head above the ground level can be reduced by having the discharge pipe submerged in the water tank at ground level. Thus the siphon action due to the U-Bend reduces the effective height through which water has to be pumped. This simple innovation can lead to reduction in fuel consumption and power electricity and diesel oil bills.

(Source : V.S. Akbar Basha, Heavy Vehicles Factory, Avadi, Madras)

4.5 Solar Basket : 3 minutes to boil one litre of water, cook rice in 15 mts., dal or chicken curry in 20 mts., or a full meal with six dishes for eight to ten persons in three hours is a astonishing work of sun basket, which effectively works from 8 a.m. to 4 p.m. on sunny days. The total cost

ranging from Rs.60/- to Rs.100/- according to different sizes of the baskets from 1.4 metres diam. to more. The basket is made out of bamboo and smoothened over inside with special papier mache (2 kg.wheat flour, 1 kg methi powder, 5 kg paper pulp(and the basket are formed over a precise paraboloid made from cement concrete or plaster of Paris. The smooth inner surface of the basket is lined with silver foil which is glued to the surface acting as reflecting parabolic mirror. The focal point of about 20 cms. rests in the centre. Tripod of bamboo poles is used to suspend the cooking vessel, with a rope, from its apex over the focal point. The basket is adjusted according to the positioning of the sun.

Note : The basket will last for 2 years.

(Source : Dr. M.Von Oppen, ICRISAT, Vilayat Manzil, Begumpet, Hyderabad - 500 016.)

4.6 Solar Cabinet Dryer : The dryer is essentially a solar hot box, in which fruit, vegetables or other matter can be dehydrated. It consists of a rectangular container, insulated

at its base and preferably at the sides and covered with a double-layered transparent roof. Solar radiation is transmitted through the roof and absorbed on the blackened interior surfaces. Holes are drilled through the base to induce fresh ventilating air into the cabinet. Outlet ports are located on the upper parts of the cabinet side and rear panels. As the temperature increases, warm air passes out of these upper apparatuses by natural convection creating a partial vacuum and inducing fresh air up through the base. As a result there is a constant perceptible flow of air over the drying matter, which is placed on perforated trays on the interior cabinet base. The solar cabinet drying of apricots in Ladakh and the results reported are very encouraging.

4.7 Solar Cooker :

(a) Simple Cooker : It has a very simple construction. A rectangular box is put into a hole dug in the earth and covered with a double layered glass lid hinged to the box. The cooking

utensils are kept inside the box on a bottom which is insulated from the box by straw or paddy husk ash. The food is cooked within three hours depending on the weather conditions.

(Source : Agro Industrial Service Centre, Bardoli (Gujarat))

(b) Reflector-type Cooker : It is an improvement over the simple box-type cooker. By adding mirrors on all sides at the opening, the incident energy is increased 4 to 6 times, thereby reducing the cooking time to between 45 minutes and 90 minutes. Further it has mechanism for adjustment in either of the planes.

(Source : Arvind Pandya, Prayog Samiti, Sabarmati.)

4.8 Solar Steam Cooker : The cooker which is suitable to cook both the mid-day meal and the evening meal. The food in the cooker remains hot for several hours after sunset. It is cheap effective device from locally available material. This cooker consists of two parts which are rigidly and permanently joined to each other. First is the solar collector that is metal

surface heated by sun causing water in the fluid pipe to boil and produce steam. The second is the insulated steam cooker in which the food containing pot is placed. The solar collector is fixed to an angle of 45 degrees and is supported on a single pivot pipe that can be fixed to the ground. The entire cooker is pointed towards the point of sunrise all morning and the points of sunset all afternoon. No frequent adjustment is essential. Best suited for food like cereals, vegetables and the like.

Note: Cost and size of the cooker will depend on locally available materials.

(Source : Brace Research Institute, Faculty of Engg.Macdonald Campus of McGill Univ , Ste. Anne de Belliru 800, Quebec, CANADA).

4.9 Solar Stills : Saline or brackish water can be converted into fresh potable water by solar distillation technique. Solar stills are simple to construct and its operation and maintenance is negligible compared to conventional desalination plants, although the capital investment and the cost of desalted water is higher. The sloping glass can also be used to collect rain water. Solar stills are suited for small rural communities. (Source : C S M C R I, Bhavnagar (Gujarat)).

4.10 Solar Water Heaters : These have also been designed by many agencies. Central Building Research Institute, Roorkee has one costing Rs. 640/- (1968 price) for an average family of five persons giving 140 litres of water at $50^{\circ}C$.

There is another design developed at Arid Zone Research Lab., Jodhpur.

Simple solar water heaters are popular in Japan and their designs can be adapted to Indian conditions.

The McGill University ... developed an inexpensive design suitable for ... agricultural purposes and can be made from easily ... materials. It can provide 30 to 40 gallons of ... per day at a temperature of 130° to ... The absorber is constructed from corrugated galvanized steel sheet ... roofing material and a sheet of 22 gauge flat ... riveted and soldered together and mounted high to be ... to the sun.

4.11 Speed Gear ... developed at the Regional Research Laboratory of the ... (Assam) for bicycle. This can increase the speed by ... or more. This mechanism could greatly reduce the ... cycle, rickshaw pullers and be utilized in other cycling arrangements utilizing manual power for traction and transport.

(Source : R.R.L. Jorhat)

4.12 Water Pump ... The animal energy on which the whole ... economy depends needs to be scientifically studied and ... efficient utilization found out.

4.13 Wind Mill :

(a) Low-cost windmills have been developed and installed for drinking water supply in rural areas
(Source : N.A.E. Belgaum)

(b) The West Bengal State Electricity Board has developed a design of a windmill to generate power. It will be installed at Sagar Island and Basant (24 Parganas).

(c) A small windmill, based on a modified sail type sav savonius rotor, has been designed and developed. The rotor is 2.5 meters in diameter and 4 meters in height. The design employs mostly wood for the structure and a fabric supported by galvanised iron wires for the aerodynamic surface.

(Source : ASTRA, Bangalore)

The manual and the bullock power has not so far been looked at as something to be improved upon evidently this is a lacuna which must be removed. The poor people who cannot afford to energize wells and some times do not even have bullocks subsisting on the small holding, are left high and dry. For them the technique of a Foot Pump and a Hand Pump cylinder has been perfected in Senegal by Mr. Gueroult and are in daily operation for 18 hours for irrigating a market garden in the suburbs of Dakar. The foot pump can lift water from the depth of 20 metres @ 1.2 cubic metres per hour. The foot pump is three times more efficient than hand pump. The super structures of both pumps as designed use steel angle bars but the same could be done by a good carpenter in wood as well. The use of ball bearing however cannot be substituted locally.

(Source : Brace Research Institute, Quebec, Canada).

The details given are based on the information made available by the various laboratories, which needs to be elaborated and in some instances made uptodate. Unfortunately due to lack of space and good editing on our part only a sketchy knowledge about the techniques mentioned could be conveyed, for which we beg to be excused. It is, however, hoped that even this rough hint of processes available in this area of rural technology will be helpful in further exploration and utilization of scienee for the dumb millions.

It is a recognized fact that adaptation of the techniques (evolved at the labs) in the field is an equally difficult step, specially so when we want to transfer technology to the villages. Here it will require all the ingenuity, imagination and inspiration at our command to translate the known techniques into channels of occupation of such people - who have lost all hopes of their development. We hope that this booklet will, in some small measure, benefit all those who are in search of means to remove the disparity and poverty that prevails in the land.

Centre of Science for the Villages,
Wardha

Director
--Devendra kumar

Centre of Science for the Villages

The Centre of Science for the Villages has been started in India at Wardha–the place where Mohandas K. Gandhi, developed his techniques for rural service-from the Museum (Magan Sangrahalaya) of new techniques for rural development and village industries, which he had started in 1938. The organisation as begun the programme which could directly help the villages of the poor countries, is trying to identify processes and techniqes which can be operated and undertaken by the poor in the villages and are experimenting the modes of transference of such technology to reach those below the poverty line. We are trying to build a bridge between the various technological and scientific laboratories on one hand and the rural poor in the villages on the other. For this, information is being collected and efforts are being made to try them out in the fields. At the same time information about lesser known techniques practised in the villages on the basis of accumulated knowledge of the ages has to be gathered and their relevance to be established in the new contex .